



## Patent portfolio in wind, turbulence and vortex

### Multi-static 3-D wind, turbulence and vortex radar

<p>This invention relates to a system for the detection and measurement of velocity, turbulence, vortices and similar irregularities or phenomena in air, including classification of such phenomena. These may comprise the wind velocity vector, clear air turbulence as well as aircraft induced vortices and turbulence. Detection and measurement as contemplated here takes place by means of electromagnetic waves.</p>	<p><b>Patents</b>          Canadian patent # 2.132.835          Norwegian patent # 306744          US patent # 5.534.868</p>
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### Radio-Acoustic wind, turbulence, temperature and vortex radar

<p><b>Patents</b>          German patent # 0829021          Norwegian patent # 301141          UK patent # 0829021          US patent # 6.070.461</p>	<p>A system for the detection and measurement of atmospheric air movement irregularities such as wind velocity vector, wind shear, downdraft, clear air turbulence, aircraft induced vortices and turbulence, in particular along a glidepath near airports, whereby an air volume under investigation is illuminated by a radio wave transmitter with a beam of coherent electromagnetic energy and a resulting wave field is received and processed in processor means to derive information on the existence of said atmospheric irregularities and furthermore to give specific measurements of related parameters, comprising at least one receiver for said resulting wave field, which is due to scattering in said air volume, positioned at a bistatic location having a selected distance from said transmitter, characterized by acoustic transmitter means located between said transmitter and said at least one receiver, and adapted to emit acoustic waves into said air volume, with frequency and beamwidth of the acoustic waves chosen such that a resulting disturbance of the dielectric constant of air in said air volume, contributes to said scattering.</p>
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## *Wind, Turbulence and Vortex measurement technology*

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Triad is a privately owned Norwegian company. Since its foundation in 1986 Triad has been engaged in research within electromagnetic and acoustic remote sensing, radar, sonar and seismic applications.

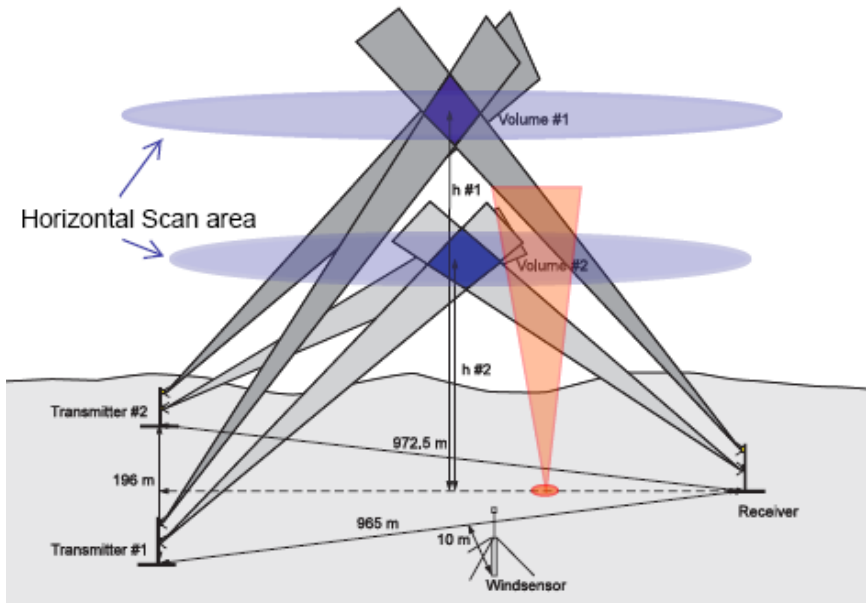
Triad holds international patents on technologies in respect to remote sensing of wind, turbulence and vortices using radar and radio-acoustic methods.

Triad is seeking contact with partners that are interested in teaming up for the commercialization of these technologies.

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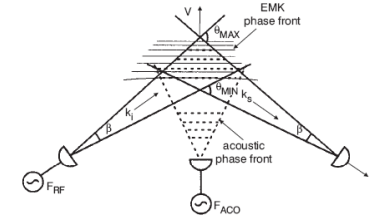
## Multi-static 3D wind, turbulence and vortex radar



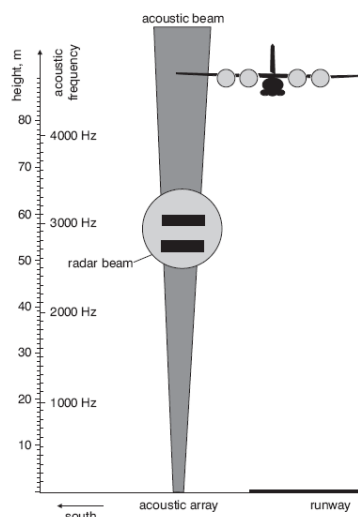
- Multi-static Doppler radar that relies on scattering from atmospheric movements in the inertial subrange
- A multi-static X-band radar system couple to scales of 1.5 - 50 cm
- Small scale turbulence is estimated by spectral processing
- 3D, large scale turbulence and vortex detection by Doppler processing
- Research at PhD-level have been performed
- Proof of concept by prototype testing at 50 –1000 meters altitude
- The system is patented in Canada, US and Norway

## Radio-Acoustic wind, turbulence, temperature and vortex radar

Measures 3D wind, turbulence, vortex and temperature along a vertical acoustic column.



Based on Bragg wavenumber matching between electromagnetic and acoustic waves.



Bi-static radar setup provides an advantage over other radio-acoustic systems and makes it possible to measure in several altitudes simultaneously with fine resolution in space and time.

Prototype testing have proved the system performance in wind, turbulence, temperature and vortex

measurements up to 200 meters altitude and have demonstrated vortex detection capability.

Patented in Norway, Germany, US and UK.

